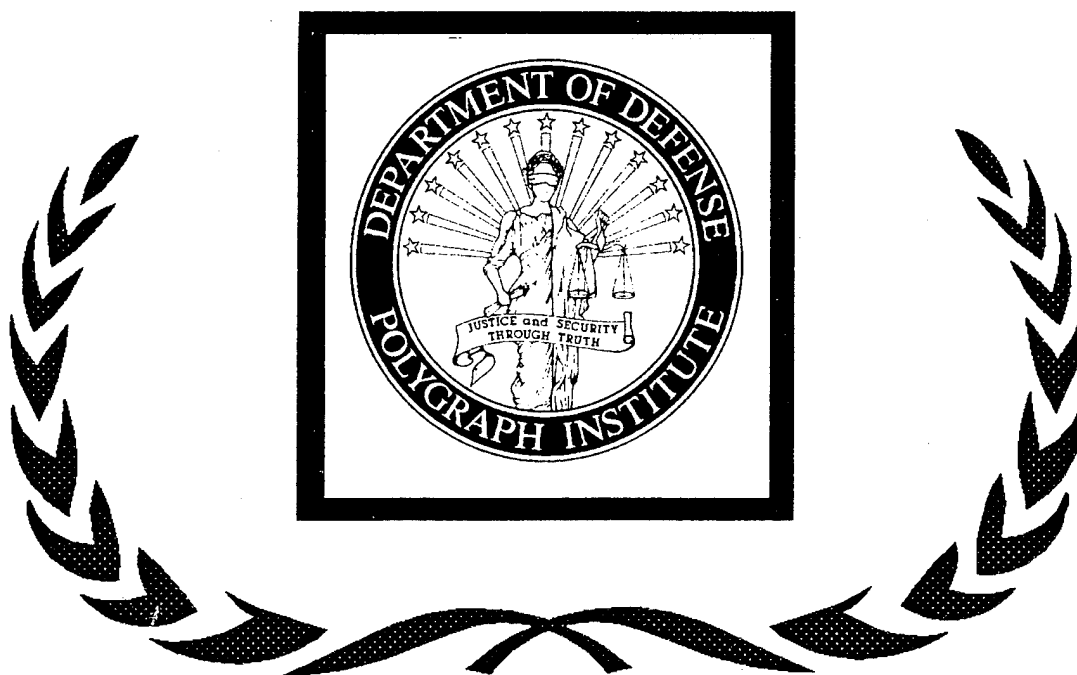


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The Relative Utility of the
Forensic Disciplines

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March 1993

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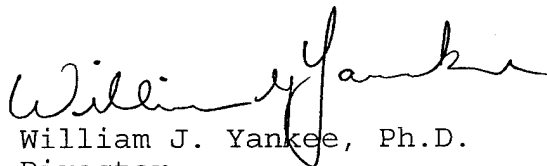
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Director's Foreword

The role of psychophysiological detection of deception (PDD) tests and test procedures, despite the emerging discipline of forensic psychophysiology (FP), is not normally recognized as a forensic science. This study is unprecedented in that it not only evaluates the utility of the various forensic sciences (including FP) but compares their relative contribution to the resolution of crimes over a specified period of time.

The findings in this study are impressive and clearly illustrate the important role of PDD in assisting in resolving crimes. Compared to the relative contribution of the other forensic sciences in the resolution of crimes reviewed in this study, PDD tests and procedures clearly out produced and out performed most of the others. In this day of resource reductions and concern for cost effectiveness, it would be interesting to study this same set of materials to establish a "cost per case resolution" for each of the forensic disciplines. This approach is not suggested to denigrate or malign the other disciplines, but rather to establish a new and different recognition level for forensic psychophysiology and its PDD processes and procedures.

Although this line of research is important to improving the public's image of FP, it is not a high priority for the Department of Defense Institute's research mission and will not likely be followed up by Institute personnel. However, it is anticipated that some of the field practitioners, upon reading this report, might pursue additional studies.


William J. Yankee, Ph.D.
Director

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Abstract

LIGHT, G. D. and SCHWARTZ, J. R. The Relative Utility of the Forensic Disciplines. March 1993, Report No. DODPI93-R-0001. Department of Defense Polygraph Institute, Ft. McClellan, AL 36205.--The efficacy of the forensic disciplines in felony criminal investigations was assessed. Reports and investigations of the findings of 1,069 forensic examinations reviewed involved 920 felony investigations conducted between 1 July and 30 December 1990 by the United States Army Criminal Investigation Command (USACIDC). The traditional laboratory disciplines combined conducted 584 (55%) and the psychophysiological detection of deception (PDD) discipline conducted 485 (45%) of the examinations. The PDD discipline provided the investigator with 432 (89%) opinions that contained positive results and the laboratory disciplines provided positive results in 431 (74%) examinations. In all categories assessed, regardless of type of crime, a higher solve rate was achieved for USACIDC when multiple forensic disciplines were utilized. The PDD discipline was the most utilized and effective of the individual disciplines, but all forensic disciplines demonstrated a high degree of utility in specific criminal offense categories. Of the 1,069 examinations reviewed, there were no instances in which the findings of one discipline contradicted the results of any other discipline.

Key-words: utility, forensic disciplines, psychophysiological detection of deception (PDD), forensic psychophysiology, polygraph

Executive Summary

LIGHT, G. D. and SCHWARTZ, J. R. The Relative Utility of the Forensic Disciplines. March 1993, Report No. DoDPI93-R-0001. Department of Defense Polygraph Institute, Fort McClellan, AL 36205.

The utility of the various forensic disciplines, including the psychophysiological detection of deception (PDD) was examined in this study. The primary objective was to determine which forensic disciplines contributed most effectively to the resolution of felony investigations within a large investigative organization. The secondary objective was to determine whether inferences could be made regarding the validity of PDD examinations in field situations.

Between 1 July and 30 December 1990, all felony investigations conducted by the Army Criminal Investigation Division (CID) Command were reviewed. Of those investigations, 920 cases were located in which at least one forensic examination had been conducted. A total of 1,079 forensic examinations had been conducted on these 920 investigations. Thus, some investigations were supported by two or more forensic examinations.

The results of the analysis disclosed that all the traditional forensic disciplines combined (fingerprints; questioned documents; firearms; serology; illicit drugs; trace evidence; and photographic) conducted 584 (55%) of the examinations. The PDD discipline alone conducted the remaining 485 (45%) examinations. The PDD discipline provided the investigator with positive results in 432 (89%) of its examinations. The laboratory disciplines provided positive results in 431 (74%) of its examinations. The solve rates in every crime category (persons, property, and drugs) increased when a forensic discipline was utilized. PDD was the most robust of all the disciplines and was used effectively in all types of crimes. The other disciplines were only applied routinely in certain specific categories of crime.

Of the 1,069 examinations reviewed, there were no instances in which the findings of one discipline contradicted the results of any other discipline. In each instance, the PDD examination was conducted first, and the laboratory examinations were conducted later. Thus, it can be inferred from this data that the validity of field PDD examinations compares favorably with the validity of the other forensic disciplines.

Further research should be conducted to replicate this study in other criminal investigative organizations. Additionally, a cost analysis should be conducted to determine the cost effectiveness of educating PDD examiners and purchasing polygraph instruments as compared to the cost of educating laboratory examiners and purchasing laboratory equipment for the other forensic disciplines.

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The support of the criminal investigator through the use of scientific evidence continues to be a multidisciplinary approach encompassing law, science, and technology (Moenssens, Inbau, & Starrs, 1986). The forensic sciences have traditionally provided the criminal investigator with expert opinions to provide links between the suspect and the crime. The forensic disciplines have been instrumental in resolving criminal investigations. However, a paucity of research exists which provides insight as to the effectiveness and utility of these forensic tools. The purpose of this study was to investigate the impact of these disciplines on criminal investigations utilizing forensic reports of examinations that supported field investigations.

An important concept in employing any forensic discipline is that the findings must be of such a recognized standard to be able to withstand the scrutiny inherent in the adversary procedures of the U.S. Criminal Justice System (Moenssens et al., 1986). Much emphasis is placed upon the use of forensic disciplines in the courtroom environment. In fact, most texts, in discussing the forensic sciences, delve extensively into "expert testimony, rules of evidence, etc...." It is understood that the utilization of forensic findings in a court of law is an important end product of any forensic examination. However, the courts are not the primary user of these findings.

The criminal justice system, right or wrong, has evolved into a process in which the vast majority of criminal offenses involving criminal suspects are adjudicated prior to the onset of actual courtroom proceedings (Cole, 1983). This process requires findings based upon information that speaks to the trier of the fact (whomever has assumed this role) in a clear, concise, and expeditious manner. The traditional laboratory disciplines (as detailed later) in the analysis of physical evidence, provide the trier of fact in some instances with real evidence which speaks for itself to relate an impression upon the mind of the trier of fact (Donigan, Fisher, Hugel, Reeder & Williams, 1980). In other cases, the laboratory disciplines provide circumstantial evidence with which an inference can be logically drawn from the known facts.

Forensic psychophysiology (Yankee, 1992), which incorporates the psychophysiological detection of deception (PDD), is included in this research to provide a comprehensive review of all the forensic support utilized by the USACIDC field element. The PDD¹ discipline is unique in that the nature of the findings and its by-products (confession/admission) are circumstantial (in the form of expert opinion), allowing the trier of fact to make an inference about the involvement of the suspect in the offense (Donigan et al., 1980). However, in most instances (72%), when deceptive findings are rendered, they are associated with legally

sufficient admissions or confessions that provide corroboration for the PDD examination and testimonial evidence for the trier of fact.

Forensic disciplines have resolved countless criminal investigations. This research was designed to be a comprehensive review of specific forensic disciplines over an extended time period in an attempt to ascertain the utility of each forensic discipline for the field investigative element. Further, the research was designed to demonstrate the impact the findings of disciplines had on the types of crimes for which the disciplines are utilized.

Method

This research study involved a total of 1,077² forensic examinations conducted between 1 July and 30 December 1990. These examinations were conducted subsequent to requests for forensic support from USACIDC special agents. This study utilized a total of 584 laboratory forensic examinations which represented all analyses completed at the United States Army Criminal Investigation Laboratory (USACIL), Ft. Gillem, Georgia during the applicable time period. The laboratory system of USACIL has three laboratories supporting the U.S. Army worldwide. The USACIL laboratory supporting the Continental United States (CONUS) was utilized for this study.

During this same time period, 493 PDD examinations were completed by USACIDC PDD examiners in support of the USACIDC criminal investigative mission in CONUS. All PDD examination reports are maintained at the United States Army Crime Records Center (USACRC), Baltimore, MD. All reports reflecting analyses completed by the forensic disciplines are retained at the United States Army Crime Records Center. The case folders for these forensic reports (and all investigative efforts) are maintained by USACIDC and are referred to as a Report of Investigation (ROI). All 1,069 forensic reports utilized for this research were obtained from these ROIs (case folders) and reflect all forensic reports that could be located for this time period investigated within CONUS by USACIDC.

A review of all forensic examinations identified eight primary forensic disciplines that were utilized in support of the USACIDC criminal investigative mission. The following eight disciplines were identified:

Firearms	Illicit Drugs
Latent Prints	Psychophysiological Detection of Deception
Questioned Documents	Serology
Trace Evidence	Photographic

A description of each of the forensic disciplines utilized for this study is provided in Appendix A.

The results provided to the investigative field elements from these eight disciplines were evaluated utilizing the following topics: The "Utility of the Forensic Principles"; the "Impact of the Forensic Disciplines"; and an "Interdisciplinary Comparison of the Results of the Forensic Disciplines."

Utility of the Forensic Disciplines

This analysis of the forensic disciplines identified how often the individual disciplines were utilized and the quantification of positive information provided to the investigative field element. This analysis involved three steps: (1) The number of forensic examinations completed in support of the USACIDC field element. (2) The impact each report had upon the investigation. This was determined by categorizing the results of those forensic analyses into the following categories:

Positive Result	Positive Result With Subject
Negative Result	Positive Result With No Subject

For a detailed discussion of the process for determining these outcomes refer to Appendix B.

3) The percentage of each forensic discipline that met the criteria for the above listed categories.

Impact of the Forensic Disciplines

This analysis of the forensic disciplines determined if a correlation existed between solve rates of felony investigations and the use of the forensic disciplines. This analyses involved: (1) Identifying investigations which had been solved wherein a forensic discipline had been utilized (a discussion of the process for determining the resolution of an investigation is contained in Appendix C). (2) Determining the number of instances each forensic discipline was involved in the resolution of an investigation based on the category of the crime. The categories of crime utilized were: crimes against property, crimes against persons, and drug investigations.

Interdisciplinary Comparison of the Results of the Forensic Disciplines

This analysis determined if reliability existed in those investigations in which a PDD examination and a laboratory examination were completed during the same investigation. The comparison of the results rendered by PDD and other disciplines was made since the USACIDC Polygraph Program is headquartered at USACRC, Baltimore, MD, while the USACIL is located at Ft. Gillem, GA. Laboratory reports are generated at the USACIL, while PDD reports are initiated by the field examiner who is conducting the PDD examinations in the geographical area where the suspect is located. The PDD report is subsequently forwarded to the quality control section of the USACIDC Polygraph Program, USACRC, where it is filed pending receipt of the final ROI at USACRC.

The review of all 32 ROIs (case folders) used in the interdisciplinary comparison affirmed that the laboratory results were not known when the PDD examinations were completed. In all instances, laboratory discipline examinations were completed weeks after PDD examinations. Additionally, the review of all requests for laboratory examinations at USACIL did not reflect the fact that a PDD examination had been completed. The 32 ROIs that met this criteria were reviewed to determine the number of instances in which contradictions between the results of the PDD and other disciplines occurred.

Results

Table 1
Utility of the Forensic Disciplines

Discipline	Positive Results	Positive Results With Subject	Positive Results Without Subject	Negative Results	Total #s Percent-age
PDD	432 (89%)	289 (60%)	143 (29%)	53 (11%)	485 (100%)
Latent Finger- Prints	90 (59%)	31 (20%)	59 (38%)	64 (42%)	154 (100%)
Questioned Documents	105 (72%)	66 (45%)	39 (27%)	40 (28%)	145 (100%)
Illicit Drugs	125 (93%)	106 (80%)	19 (14%)	8 (6%)	133 (100%)
Firearms	39 (76%)	14 (27%)	25 (49%)	12 (24%)	51 (100%)
Trace Evidence	33 (65%)	14 (28%)	19 (37%)	18 (35%)	51 (100%)
Serology	34 (85%)	20 (50%)	14 (35%)	6 (15%)	40 (100%)
Photo- graphic	5 (50%)	1 (10%)	4 (40%)	5 (50%)	10 (100%)

The Utility of the Forensic Disciplines

A total of 1,069 forensic examinations were reviewed during this portion of the study. The PDD discipline conducted 485 (45%) of all forensic examinations completed, while the latent fingerprint and the questioned document disciplines were each utilized in 14% of the examinations.

The individual disciplines demonstrated that "positive results" were provided to the field elements most often by the illicit drug discipline (93%), followed by PDD (89%), and serology (85%). A "positive result with subject" was demonstrated most often by the illicit drug discipline (80%), followed by the PDD discipline (60%). The latent fingerprint discipline provided "positive results with subject" in 20% of the examinations provided to the field element.

In the "positive results without subject" category, the firearms discipline provided a laboratory report meeting this criteria in 49% of the laboratory examinations, while the latent fingerprint discipline provided a report in this category in 38% of the examinations. In the "negative results" category, the latent fingerprint discipline provided 42% of the reports in this category. Trace evidence provided "negative results" in 35% of the reports in this category.

Table 2
Impact of the Forensic Disciplines

Total Exams	Laboratory Exams	PDD Exams	USACIDC Solve Rate	Interdiscipline Solve Rate	Non-Discipline Solve Rate	PDD Solve Rate	Laboratory Solve Rate
914	421	493	81%	86%	78%	82%	81%

Impact of the Forensic Disciplines

In reviewing all case folders available at the USACRC, 914 forensic examinations were identified for use in this study. The 914 case folders (ROIs) were located to determine if the investigation had been solved. As a result, 421 examinations completed by USACIL and 493 of the PDD examinations completed by the USACIDC were located.

In this study an investigation is determined to be resolved when a person is titled in the investigation. (See Appendix C for detailed discussion of this process.) The frequency with which crimes are resolved will indicate the effectiveness of the investigative process. The ratio for solved investigations is determined by dividing the number of investigations resolved by

the number of investigations completed. This solve rate will indicate the effectiveness of the forensic disciplines. The interdisciplinary solve rate (ROIs involving both PDD and laboratory examinations) was 86%. The solve rate for investigations involving only the laboratory disciplines was 81%. The solve rate for investigations involving only the PDD discipline was 82%. The overall USACIDC solve rate (all investigations) was 81%. The solve rate in which USACIDC utilized no forensic discipline during an investigation was 78%.

Table 3
Crimes Against Property Solve Rate

Crimes Against Property	Laboratory Exams	PDD Exams	Latent Finger Prints	Question- ed Documents	All Other Laboratory Disci- plines					
# of Exams/ Solve Rate	# of Exams Con- duct- ed	Solve Rate	# of Exams Con- duct- ed	Solve Rate	# of Exams Con- duct- ed	Solve Rate	# of Exams Con- duct- ed	Solve Rate	# of Exams Con- duct- ed	Solve Rate
473/71%	234	75%	239	67%	95	69%	102	77%	37	80%

The impact of the forensic disciplines upon specific categories of crimes is as follows:

Crimes Against Property

The solve rate for all USACIDC investigations which occurred during the applicable time period in this category was 56%. The solve rate for those investigations in which a forensic discipline was utilized was 71%. The solve rate for those investigations in which a laboratory discipline (completed at USACIL-CONUS) was involved was 75%, while the PDD discipline was 67%.

In reviewing the ROIs (case folders) in this category involving only solved crimes in which a forensic discipline was utilized, a total of 334 examinations were identified. The forensic disciplines of PDD, questioned documents, and latent fingerprints were involved in solving 91% (304 of 334) of those examinations. PDD was involved in resolving 47% (159 of 334 examinations) of the property crimes. Questioned documents were involved in 24% (79 of 334 examinations) of those solved investigations. Latent fingerprints were involved in the resolution of 20% (66 of 334) of those investigations. The remaining disciplines combined were involved in 9% (30 of 334) of the remaining investigations.

Table 4

Crimes Against Persons Solve Rate

Crimes Against Persons			Laboratory Exams		PDD Exams		Latent Finger Prints		Trace Evidence		Serology	
# of Exams/ Solve Rate	# of Exams Con- duct- ed	Solve Rate	# of Exams Con- duct- ed	Solve Rate	# of Exams Con- duct- ed	Solve Rate	# of Exams Con- duct- ed	Solve Rate	# of Exams Con- duct- ed	Solve Rate		
309/93%	124	91%	185	94%	30	90%	30	97%	26	90%		

Crimes Against Persons

The solve rate for all USACIDC investigations which occurred during the applicable time period in this category was 89%. The solve rate for those investigations in which a forensic discipline was utilized was 93%. The solve rate for those investigations in which a laboratory discipline (completed at USACIL-CONUS) was involved was 91%, while the PDD discipline was 94%.

In reviewing the case folders in this category involving only solved crimes in which the forensic disciplines were utilized, a total of 282 examinations were located. The disciplines of PDD, trace evidence, latent prints, and serology were involved in 264 (94%) of the examinations. The PDD discipline was utilized in 62% (175 of 282 examinations) of those crimes against persons. The trace evidence discipline was utilized in 10% (29 of 282 examinations) of those investigations. Latent fingerprints were involved in the resolution of 10% (27 of 282 examinations) of those investigations. The serology discipline was utilized in 9% (26 of 282 examinations) of those investigations. The remaining disciplines combined are responsible for the resolution of 9% (25 of 282 examinations) of the investigations.

Table 5

Illicit Drugs Solve Rate

Total Exams: Illicit Drugs		Laboratory Exams		PDD Exams	
		# of Exams Conducted	Solve Rate	# of Exams Conducted	Solve Rate
132		63	100%	69	97%

Illicit Drugs

The solve rate for all USACIDC investigations which occurred during the applicable time period in this category was 99%. The solve rate for those investigations in which a forensic discipline was utilized was 99%. The illicit drug discipline was utilized in 63 investigations and all investigations were solved. The PDD discipline was utilized in 69 examinations and 67 were solved.

Interdisciplinary Comparison

In reviewing all ROIs (case folders) at the USACRC, Baltimore, MD, during the applicable time period for this category, a total of 32 investigations were identified in which at least one laboratory forensic examination (completed at USACIL-CONUS) and one PDD examination was completed during the same investigation. Further, 47 laboratory examinations were conducted in support of those 32 investigations, while the PDD discipline completed 32 examinations in support of the same 32 investigations. In comparing the results of all 79 forensic examinations identified in this study, in no instance did any forensic finding contradict another discipline.

Of the 47 laboratory examinations completed, 33 rendered a conclusive opinion in support of 25 investigations. Of the 32 PDD examinations, 29 resulted in conclusive opinions being rendered. A total of 24 investigations were identified in which conclusive opinions were rendered by PDD and the laboratory disciplines in the same investigation. In all 24 investigations, the laboratory and PDD rendered the same opinion pertaining to the same subject of that investigation.

In considering the impact of the PDD and laboratory disciplines in resolving these investigations it was found that in 20 ROIs a subject was identified by the laboratory discipline. Of the 29 positive results obtain by the PDD discipline, 26 of the examinations resulted in a subject being identified. The PDD discipline rendered 3 no opinion findings, in comparison to the 14 no opinion examinations rendered by the laboratory disciplines.

As demonstrated, in 24 out of 32 ROIs, PDD and the forensic disciplines concurred in positive findings and a subject was titled in those investigations. In 20 of the 32 investigations, confessions/ admissions were obtained during the course of the investigations. The confessions/admissions were obtained in 19 of the 20 PDD examinations and one in support of the laboratory examinations without a PDD confession. It should be noted that in 2 of the 24 ROIs the laboratory and PDD disciplines concurred that an individual was not involved in the incident. The validity of the PDD opinions were confirmed in all 24 ROIs. In 20 of the 24 ROIs both a laboratory discipline and a confession

confirmed the PDD result and in the remaining 4 ROIs the PDD opinion was confirmed by the laboratory discipline.

Discussion

To our knowledge, this study represents the first comprehensive research effort in which actual field data has been utilized to compare the effectiveness and utility of the findings routinely provided by a major crime laboratory in support of felony investigations. The effect of the forensic disciplines on solving investigations held consistent throughout this study. The forensic disciplines were found to be more (or less) effective based upon the category as well as the specific type of crime involved. For example, the illicit drug discipline was extremely effective in drug investigations, but was not utilized in crimes against property or crimes against persons investigations. The questioned documents discipline was seldom used in crimes against persons investigations, and the serology discipline was seldom appropriate in crimes against property investigations. In contrast, PDD was used effectively in every type of crime that was investigated. For instance, in the 24 child abuse cases included in this study, PDD was the only forensic discipline utilized. The findings indicate that if both PDD and the laboratory forensic disciplines are utilized, the solve rate for the investigative field element is significantly increased. When the forensic disciplines are utilized separately in crimes against property, the laboratory disciplines have a significant positive impact in increasing the USACIDC solve rate. In crimes against persons, the solve rate for USACIDC was increased when PDD was utilized exclusively.

The findings of greater utility with certain disciplines based upon the examination and analysis of various physical evidence types is consistent with the findings of Widacki and Horvath (1978). When utilizing an analog study, they found a 100% accuracy rate with fingerprint examinations but found that fingerprints could only render a positive opinion with subjects in 20% of examinations. Widacki and Horvath also found PDD and handwriting examinations resulted in a high accuracy (90% and 85%, respectively) while rendering a positive result with subjects in 95% and 94% of the examinations. The fingerprint, handwriting, and PDD results were consistent with the results in this study. In Widacki and Horvath (1978), the examiners in all forensic disciplines were experienced, well trained, and employed standardized procedures. Other research (Raskin & Podlesney, 1979; Patrick & Iacono, 1988) also found the validity of PDD to be over 90%, when professionally trained PDD examiners utilizing standardized procedures conducted a PDD examination.

The Laboratory Proficiency Testing Research Program (1979) demonstrated that certain laboratories which lacked trained personnel and suffered from budgetary constraints produced

significant "unacceptable responses" in examinations involving blood and paint samples³. The present research project identified no discipline in which an error by a laboratory discipline occurred. However, there were a significant number of no opinion and "positive without subject" findings, which is also consistent with the findings of Widacki and Horvath (1978).

The Laboratory Proficiency Testing Research Program, under certain conditions, recognized an inconclusive opinion as an error. This research project did not consider an inconclusive opinion as an error. The use of an inconclusive opinion allows the forensic professional the right to say "I don't know" (Willard, 1982). Without this ability, forced erroneous opinions would result.

The USACIL is staffed with expertly trained professionals who maintain and enforce stringent quality control procedures. These standards require the use of the inconclusive opinion. The Laboratory Proficiency Testing Research Program (1979) indicated that the lack of quality control procedures and the failure to adhere to those procedures which do exist was a major contributor to the errors in some laboratories.

PDD appears to be the most robust of all forensic disciplines due to its applicability to more types of criminal investigations. PDD examinations alone accounted for 45% of all forensic examinations. The findings of utility with the laboratory disciplines are consistent with crime resolution. The disciplines are most often in those types of crimes in which they have higher solve rates. Therein lies the rationale for the significantly higher utility of PDD. The laboratory disciplines depend on the existence of traditional physical evidence which can be examined and analyzed. These circumstances do not normally pose a problem for the forensic psychophysicist. A PDD examination is conducted based upon the individual's concealed knowledge of the criminal event -- unlike the requirements physical evidence impose on the laboratory disciplines. With PDD, the evidence linking the suspect to the crime exists in the mind of the perpetrator for every criminal offense.

The final comparison of this research project was originally designed to ascertain in what context do discrepancies between the forensic disciplines occur. In no instance were any contradictions between laboratory disciplines identified. This is particularly significant when considering that all of the findings of the PDD and laboratory examinations were achieved autonomously. In every instance, the PDD examination was completed before the results of the laboratory examination had been completed.

Most opponents of PDD procedures have argued that the high accuracy of PDD examinations in some laboratory studies cannot be generalized to the field environment (Office of Technological Assessment [OTA], 1983). This is due largely to the fact that ground truth is difficult to establish in the field environment (Lykken, 1979). The findings of this comparison support other studies that utilized the confession as ground truth (Barland & Raskin, 1976; Patrick & Iacono, 1988). In these studies, PDD was found to have been over 90% accurate in the field setting. Iacono (1991) asserts that sample bias creates "substantial methodological shortcomings" (p.201), and that PDD examinations which historically have been selected for studies based on confessions are a select group and reflect bias in favor of PDD. While there can be no question that examinations verified by confession are a unique subset of PDD examinations, this study indicates that this bias has a minimal impact, and confession-based samples would accurately reflect the overall population.

This assertion is further substantiated by a study conducted by Mason (1988), wherein 111 PDD examinations were conducted in which ground truth was ascertained by urinalysis examinations. The validity of PDD (verified by these biomedical tests) was in excess of 95% and if utilizing confessions in conjunction with the urinalysis forensic discipline, accuracy of that confession subset would be over 98%.

Another means of reviewing PDD results was utilized by Peters (1982) in which he reviewed 220 PDD examinations. After stipulation for admittance into a state court a PDD examination was conducted. Based upon the outcome of the judicial proceedings, Peters found "the vast majority of settled cases were resolved in a manner consistent" (p. 164) with the PDD results (93.1%). Further, 98.8% of the defendants had the charges dropped when they were opined to have been truthful during a stipulated examination.

Additional research relating to the interdisciplinary comparison of forensic disciplines is warranted. This methodology not only addresses the reliability between forensic disciplines, but also provides an excellent process with which to address the issue of ground truth in a field situation by means other than confession. This process does involve a particular subset of criminal investigations (i.e. only those investigations involving multiple forensic examinations). However, this subset cannot be considered as biased favoring PDD, as is often argued regarding research projects involving field PDD examinations in which the sample is selected based upon confession.

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Footnotes

1. For the purposes of this research project the term PDD will be used to refer to a body of techniques that is popularly known as polygraphy. The term polygraph, historically has engendered the perception of a mechanical method utilized for detecting deception. However, PDD is deemed appropriate as a more accurate description of the psychophysiological processes involved in the procedures utilized by the United States Army Criminal Investigation Command in support of their criminal investigative mission.
2. The number 1,077 represents the computer-generated total of forensic examinations conducted during this time period in which results could be determined utilizing the database. However, since some investigations initiated in 1990 have not yet been closed, only 1,069 of the reports could be located.
3. USACIL was not among the laboratories which were reviewed by the Laboratory Proficiency Testing Research Program.

Appendix A

Discipline Descriptions

The eight primary disciplines utilized in this study are depicted below. This list is meant to describe, for the purposes of this research, the primary types of analyses conducted by the different laboratory divisions within USACIL-CONUS and the PDD conducted by the USACIDC Polygraph Program. The list is a guide for the reader in understanding how the different disciplines were categorized based upon the analyses completed during the reviewed time period.

Questioned Documents

The review of evidence in this discipline included, but was not limited to, the forensic examination of handwriting and hand printing identifications, typewriting identifications and comparisons, erasures, obliterations, alterations, composition of major types of writing inks, paper comparisons and datings, charred documents, evidence of alterations, writing with the unaccustomed hand, analysis of inks, and imprinting or stamping machines.

Illicit Drugs

The review of evidence in this discipline involved the forensic examination of substances submitted to USACIL-CONUS suspected of being controlled substances as defined by the Comprehensive Drug Abuse Prevention and Control Act. Street drugs and prescription drugs of abuse are included in these definitions.

Latent Fingerprints

The review of evidence in this discipline involved the forensic examination of evidence submitted in order to identify if latent fingerprints were found at the scene and subsequently to ascertain if identifiable latent prints could be matched to a suspect, a victim, or other persons.

Serology

The review of evidence in this discipline included, but was not limited to, the forensic analysis of blood evidence (the identification of bloodstains, determination of species origin, techniques for the determination of blood groups, etc.); other biological matter (sperm cells, saliva, perspiration, etc.); and DNA referrals to other laboratories with the requisite capabilities.

Trace Evidence

The review of evidence in this discipline included, but was not limited to, the forensic analysis of hair; fibers; paint; flammables; soil; dust; and the identification and comparison of other minute particles, objects, and liquids.

Firearms

The review of evidence by this discipline included, but was not limited to, the forensic analysis of firearms, bullets, cartridge casings, the operational capability of a weapon, gunshot residue, tool mark identification, and the operational nature of locking devices.

Photographic Division

This discipline involved few (10) actual forensic examinations. However, photographic support is included as one of the seven laboratory division categories for this project as it was the most appropriate category for these particular examinations. It is noted that the photography division of any criminalistics laboratory provides a number of special processes for the criminalist lab and the selection of the particular task depends upon the type of evidence involved and the result sought. Examples of specific photographic support to other disciplines would be: filters to emphasize certain colors or suppress others; infrared photography to assist in the discovery of erasures on documents; reveal blood stains, etc. The particular examinations completed for this project included, but were not limited to, videotape restoration, enlargements, or specialized film development.

Psychophysiological Detection of Deception

The review of evidence by this discipline included the process of determining if a person is attempting to deceive or is being truthful to an issue in question. This conclusion is arrived at by considering: Stimuli (questions) are presented and are psychologically evaluated by the examinee. The subjective interpretation of the stimuli will affect the activity levels of the selected physiological functions that are recorded (Yankee, 1992). These recordings are quantified and the diagnosis rendered.

Appendix B

DATA COLLECTION PROCEDURES

The following is a list of the four possible outcomes of each laboratory discipline determined by opinions rendered in the USACIL-CONUS laboratory reports:

Positive Result

The results of the laboratory analysis were positive if they provided the user with investigative information which might lead to the resolution of the criminal investigation.

Positive Result with Subject

The results of the laboratory analysis were positive and the information from that analysis provided sufficient information amounting to a reasonable belief that the suspect committed the criminal offense that was the source of the laboratory request.

Positive Result with No Subject

The results of the laboratory analysis were positive if they provided the user with an investigative clue that might lead to the resolution of the criminal investigation, but the information from that analysis did not provide sufficient specific information about an individual to amount to a reasonable belief that the person was involved in the commission of the criminal offense that was the source of the laboratory request.

Negative Result

The results of the laboratory analysis provided no positive information that would assist the investigator with an investigative lead or to identify the perpetrator of the criminal offense that was the basis for the laboratory request.

OUTCOMES BY DISCIPLINE

The following are examples of criteria for determining the four outcomes for each discipline:

Questioned Documents

Positive Result

1. The forensic examination revealed that an individual was possibly the author of the questioned documents.
2. The document submitted was determined to have been altered or that the victim did not author the questioned writings.

Positive Result With Subject

1. The forensic examination revealed that an individual was the author of all or part of the writings on the questioned document.

2. The forensic examination revealed that the document had been altered and the victim or custodian had alleged otherwise.

Positive Result With No Subject

1. The forensic examination revealed that the document had been altered but could not identify or eliminate any individual(s) as having made any of the writings on the questioned document.

2. The forensic examination revealed that the printing on the questioned document had been typed by a specific typewriter but no specific subject was identified.

Negative Result

1. Forensic examination revealed that no one could be identified or eliminated as having been the author of the questioned documents.

2. Forensic examination revealed that the word processor suspected to have been utilized to create the questioned document could not be identified or eliminated.

Illicit Drugs

Positive Result

1. Forensic examination revealed that the substance submitted was determined to be a controlled substance.

2. Forensic examination revealed that the substance submitted was determined not to be a controlled substance and the substance was identified.

Positive Result With Subject

Forensic examination revealed that the substance submitted was determined to be a controlled substance and the substance was linked to an individual.

Positive Result With No Subject

1. Forensic examination revealed that the substance submitted was determined to be a controlled substance and the substance was not linked to an individual.

2. Forensic examination revealed that the substance submitted was determined not to be a controlled substance.

Negative Result

Forensic examination revealed that no determination could be made about the substance submitted.

Latent Fingerprints

Positive Result

Forensic examination revealed that the material submitted contained latent fingerprints suitable for identification.

Positive Result With Subject

Forensic examination revealed that the material submitted contained latent fingerprints suitable for identification and that the latent fingerprints matched those of a suspect.

Positive Result With No Subject

Forensic examination revealed that the material submitted contained latent fingerprints suitable for identification but that the latent fingerprints did not match any suspect fingerprints submitted.

Negative Result

Forensic examination revealed that the material submitted did not contain any latent fingerprints suitable for identification.

Serology

Positive Result

1. Forensic examination revealed that the substance submitted was determined to be human blood.
2. Forensic examination revealed that the substance submitted was determined to contain sperm cells.

Positive Result With Subject

1. Forensic examination revealed that the substance submitted was determined to be a blood type which is the same type as the suspect. This type of blood is found in a certain percentage of people.
2. Forensic examination revealed that the substance submitted was determined to contain human saliva. The blood type of the saliva is the same as the suspect. This type of blood is found in a certain percentage of people.

Positive Result With No Subject

1. Forensic examination revealed that the substance submitted was determined to be blood, but not enough of a sample was submitted to further identify the sample.
2. Forensic examination revealed that the substance submitted was determined to contain human saliva. No further identification of the sample could be completed.

Negative Result

Forensic examination revealed that no determination could be made about the substance submitted.

Trace Evidence

Positive Result

1. Forensic examination revealed that the material submitted contained a substance identified as an accelerant.

2. Forensic examination revealed that the material submitted contained paint fragments which could be identified as being similar to the type related to the suspect.

Positive Result With Subject

1. Forensic examination revealed that the material submitted from the suspect's clothing contained a substance identified as an accelerant.

2. Forensic examination revealed that the material submitted contained paint and glass fragments which could be identified as having originated from the suspect vehicle.

Positive Result With No Subject

1. Forensic examination revealed that the material submitted contained a substance identified as an accelerant.

2. Forensic examination revealed that the material submitted contained paint fragments which could not be identified or eliminated as matching the suspect vehicle.

Negative Result

Forensic examination revealed that the material submitted could not be identified.

Firearms

Positive Result

1. Forensic examination revealed that the projectile submitted was fired by the weapon submitted.

2. Forensic examination revealed that the locking device submitted was in operational order and no signs of tampering were noted.

Positive Result With Subject

1. Forensic examination revealed that the projectile submitted was fired by the suspect's weapon.

2. Forensic examination revealed that the locking device submitted had been cut by the bolt cutters found in the possession of the suspect.

Positive Result With No Subject

1. Forensic examination revealed that the weapon submitted was operational, but the projectile could not be identified or eliminated as having been fired by the weapon submitted.

2. Forensic examination revealed that the lock submitted was cut by a device such as bolt cutters; however, the bolt cutters submitted could not be identified or eliminated as having cut the submitted locking device.

Negative Result

1. Forensic examination revealed that the projectile submitted could not be identified or eliminated as having been fired by the weapon submitted.
2. Forensic examination revealed that the bolt cutters submitted could not be identified or eliminated as having cut the submitted locking device.

Photograph Division

Positive Result

1. Forensic examination revealed that the negatives submitted were restored and prints were successfully developed.
2. Forensic examination revealed that still photographs were developed and enlarged from the videotape submitted.

Positive Result With Subject

Forensic examination revealed that the negatives were developed and photographs with negatives of the suspect's likeness were successfully developed.

Positive Result With No Subject

Forensic examination revealed that the negatives submitted were restored and developed, but no images or likenesses of any persons were observed on the negatives or prints.

Negative Result

1. Forensic examination revealed that the negatives submitted could not be restored or developed.
2. Forensic examination revealed that all attempts to develop still photographs from the submitted videotape were unsuccessful.

Psychophysiological Detection of Deception

Positive Result

The examiner, with subsequent quality control concurrence, rendered an opinion of deception or no deception indicated as a result of the completed PDD examination. These findings provide the user with investigative information which might lead to the resolution of the criminal investigation.

The following definitions are those adhered to within the Department of Defense, in accordance with Department of Defense Directive 5210.48R (Draft) December 1990.

Deception Indicated (DI)

A PDD examination result based on analysis of PDD charts indicating that an examinee's physiological responses indicated deception when answering relevant questions concerning the matter under investigation.

No Deception Indicated (NDI)

A PDD examination result based on analysis of PDD charts indicating that an examinee's physiological responses did not indicate deception when answering relevant questions concerning the matter under investigation.

Inconclusive

A PDD examination result based on analysis of PDD charts indicating that a conclusive determination (NDI or DI) could not be made.

No Opinion

A term used to describe the overall results of a PDD examination wherein circumstances prevent the examiner from obtaining sufficient criteria to form an opinion.

Positive Result With Subject

The results of the PDD examinations in this category were separated into DI and NDI.

Deceptive (DI)

An opinion of DI accompanied by information received from the individual undergoing the PDD examination that amounted to a statement against his or her self-interest (admission/confession) or the information developed during the PDD examination provided the investigation with a suspect based on this information.

Non-Deceptive (NDI)

An NDI opinion, accompanied by information received from the individual undergoing the PDD examination that another person was identified as the perpetrator of the offense. In order for an examination to be identified within this category, the other person identified in the Report of Investigation (ROI) would have to have been listed in the "Title Section" of the ROI. In order for the other person to have been listed in the title portion of the investigation, a prosecutor would have to opine that enough criminal information and probable cause exists to believe that the other person committed the offense for which the PDD examination was requested.

Positive Result With No Subject

The examiner, with subsequent quality control concurrence, rendered an opinion of DI or NDI, but no individual could be identified as a result of the PDD examination.

Negative Result

The examiner, with subsequent quality control concurrence, rendered an opinion of inconclusive or no opinion as a result of the completed PDD examination.

Appendix C

Resolution Criteria

During the course of an investigation, the investigator relies on differing types and amounts of evidence and/or information to indicate a suspect's involvement or lack thereof, in the criminal offense. The credence or weight attached to the various forensic disciplines by the field investigative element is not known. A method of reviewing the value or weight placed in the forensic sciences by the field element and to further consider the utility of the forensic sciences in the real world setting would be to ascertain the degree to which the forensic disciplines assist in the resolution of the investigation. Of the 914 analyses reviewed during this project, the 920 ROIs which contained these analyses were located for review at USACRC, Baltimore, MD. A portion of this review consisted of determining the number of ROIs that resulted in an individual being officially listed as the person who was criminally involved in the offense. An individual who is identified as having been criminally involved in the offense is listed within the "Title Section" of a USACIDC ROI. In order for a person to be listed in the title section of a USACIDC ROI, an established standard of proof must be met. This standard is: Probable cause must exist that a crime was committed and that this individual committed the offense. The process utilized by USACIDC for making this determination is not arbitrary, but one that is relatively consistent throughout USACIDC.

In order to place a person in the title section, initially, the USACIDC special agent who has conducted the investigation or is responsible for the investigation, will attain a level of proof through the investigative process that would cause the special agent to opine that probable cause exists to believe the suspect committed the offense. Once the investigator believes this level of proof has been reached, the special agent refers the ROI to a supervisory special agent who will review the investigation. If the supervisor concurs that a sufficient level of proof exists, the investigative special agent briefs the prosecuting attorney on the investigation to ascertain if the prosecutor believes the probable cause standard has been met. The prosecutor, when making a determination that this standard has been met, understands that this same prosecutor will be expected to assure that subsequent judicial action is taken against that individual. It should be understood that once a person is titled in a USACIDC ROI, upon completion of the investigative and administrative processing of the ROI, the completed ROI is forwarded to the commander or the agency in charge of the person who is titled in the ROI. This commander or agency head is then required (by Army regulation) to take action against the individual or provide written justification as to why no action was taken. The attorney who concurs with the listing of

the person in the title section of the ROI is usually the attorney who will be responsible to the commander or the agency head for taking subsequent judicial action against that individual. Therefore, prosecuting attorneys are usually careful when concurring with the USACIDC special agent in placing an individual in the title section of a USACIDC ROI.

It is interesting to note that PDD has not always been considered a traditional forensic discipline. This is ironic since the PDD discipline was an integral part of the first National Crime Laboratory at Northwestern University School of Law (Keeler, 1935). In 1935, a proposed expansion of this laboratory called for "... two psychophysiological laboratories for lie detection." (Keeler, 1935). This established the National Crime Laboratory as the prototype for many of the current forensic disciplines and laboratories.

As noted with the USACIDC Polygraph Program, this PDD program, as well as many PDD programs, are not physically located within most crime laboratories because of the portability of the PDD instrument and the need for mobility of PDD examiners. Most large investigative organizations assign PDD examiners to different geographical locations to ensure this forensic tool is available to the field investigator. The portability of the instrument, combined with the broad application of PDD examinations to virtually all types and categories of crimes, accounts for the fact that PDD was utilized in a far greater number of investigations than other forensic disciplines.

Practicing forensic psychophysiologicalists have argued that the accuracy of PDD tests will be greater in real life situations than in laboratory studies (OTA, 1983). This phenomenon may occur since arousal associated with the commission of a mock crime in a laboratory study is not likely to produce physiological responses in the guilty subjects as great as the magnitude of the physiological responses of subjects guilty of an actual crime.

Based on the data utilized in this study, the reliability co-efficient between the PDD discipline and the other laboratory disciplines is 100%. This fact certainly establishes the reliability, if not the validity, of the PDD examination in the field. If one were to question the validity of the PDD results, one would also have to question the validity of the corresponding results of the other forensic disciplines. The validity of PDD was further reinforced when utilizing those 22 ROIs in which a confession was obtained. All ROIs in which a confession was elicited confirmed the PDD results. It is also interesting to note, given the data included in this report, that the results of the other forensic disciplines are routinely admitted in court, while the results of PDD examinations are normally excluded from admission as evidence in criminal trials (Perry, 1990).

The U.S. Army CID Command is one of the finest investigative entities in existence in the United States. USACIDC's high solve-rate alone of 81% establishes this fact. Additionally, USACIDC laboratory and PDD examiners receive the most demanding and comprehensive training and education available in their specialties. The quality control standards for all disciplines are extensive and adhered to by both USACIL and the USACIDC Polygraph Program. There are crime laboratories and polygraph activities which fail to maintain such standards. In order for other entities to attain the high rate of correlation and lack of contradiction in forensic results of this research project, those entities must require similar standards of their crime laboratories and PDD programs.